Statement of Basis for the Proposed Expansion of the Aquifer Exemption for the Sisquoc and Monterey Formations, Cat Canyon Oil Field

Field:	Cat Canyon Oil Field
County:	Santa Barbara County, California
Class and Well Type:	Class II, Water Disposal and Enhanced Oil Recovery
Geologic Formations:	Sisquoc and Monterey Formations
Federal Exemption Criteria:	40 CFR §§ 146.4(a) and 146.4(b)(1)

The California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (Division), in consultation with the staff of the State Water Resources Control Board (State Water Board) and the Central Coast Regional Water Quality Control Board (collectively, the Water Boards), is considering recommending that the United States Environmental Protection Agency (US EPA) expand the existing aquifer exemptions for the Sisquoc and Monterey Formations in the Cat Canyon Oil Field by designating additional portions of the Sisquoc and Monterey Formations in the Cat Canyon Oil Field (Proposal Area) exempted aquifers under the Safe Drinking Water Act for purposes of receiving fluids from Class II injection wells. This document summarizes the basis for the Division's potential recommendation.

SYNOPSIS

In 1983, subject to ongoing US EPA supervision, the US EPA granted the Division primary authority to regulate Class II injection in California for purposes of achieving the objectives of the Safe Drinking Water Act. These objectives include regulating Class II injection to ensure that current or anticipated sources of drinking water are not endangered. Federal regulations broadly define underground sources of drinking water as any geologic formation that contains water with a total dissolved solids composition of less than 10,000 milligrams per liter in a sufficient quantity to supply a public water system. Class II injection encompasses injection for enhanced oil recovery (e.g., injection of water or steam to increase oil production) and for disposal of produced fluids associated with oil and gas production.

As part of its ongoing supervision of Safe Drinking Water Act implementation, the US EPA retains authority to designate specific water-containing geologic formations (i.e., aquifers) "exempt" from presumptive classification as a source of drinking water. This aquifer exemption process involves a careful case-by-case evaluation of characteristics affecting the aquifer's potential for use as a

source of drinking water based on specific criteria set by federal law. The Division, with concurrence from the State Water Board, may submit a proposal to the US EPA recommending that an aquifer be designated "exempt" for the purpose of receiving fluids from Class II injection wells. Although the decision to designate an aquifer exempt ultimately rests exclusively with the US EPA, California state law adds additional criteria that the Division and Water Boards must evaluate before proposing an aquifer exemption to the US EPA. These state law criteria are intended to help ensure that injection activity will not negatively affect waters of potential beneficial use. The federal and state components of the aquifer exemption process are important mechanisms for regulating the safe operation of Class II injection in California.

Concurrent with its grant of primary authority to the Division in 1983, the US EPA designated an aquifer exemption for portions of the Sisquoc and Monterey Formations within the Cat Canyon Oil Field. The boundaries of this aquifer exemption were based on information available at that time. In 2017, several operators of wells located in the Cat Canyon Oil Field jointly requested that the Division propose to the US EPA an expansion of the existing aquifer exemptions for the Sisquoc and Monterey Formations, utilizing newer and more detailed information. Based on a rigorous review of the supporting information, and with preliminary concurrence from the State Water Board, the Division has determined that the portions of the Sisquoc and Monterey Formations identified as the Proposal Area appear to meet the criteria for proposal of an aquifer exemption recommendation to the US EPA.

In accordance with section 146.4 of title 40 of the Code of Federal Regulations (40 CFR), the information presented in the proposal materials supports a conclusion that the Proposal Area does not currently serve as a source of drinking water, and that the Proposal Area cannot now and will not in the future serve as a source of drinking water, because it is hydrocarbon producing or contains hydrocarbons that are expected to be commercially producible. In accordance with California Public Resources Code (PRC) section 3131, information presented in the proposal materials also supports a conclusion that injection of fluids into the Proposal Area will not affect the quality of water that is, or may reasonably be, used for any beneficial use, and that injected fluids will remain confined in the Proposal Area.

If approved by the US EPA, this aquifer exemption proposal would clarify that the Proposal Area may be a suitable location for Class II injection to occur. However, approval of the proposed aquifer exemption would not, by itself, authorize any new injection activity. Approval to operate a Class II injection project involves a regulatory process separate from aquifer exemption. The approval process for operation of a Class II injection project includes evaluation of well construction, pressure limits, and many other project-specific details not considered in the context of an aquifer exemption proposal.

Additional information about this aquifer exemption proposal may be found in the supporting proposal materials.

LOCATION

The Proposal Area is in the Cat Canyon Oil Field in Santa Barbara County. The Proposal Area's westernmost extent is approximately four miles east-southeast of the center of the city of Orcutt, and it trends semi-parallel to U.S. Route 101 about ¾ of a mile to the east. A map depicting the boundaries of the Proposal Area appears at the end of this document.

AQUIFER EXEMPTION CRITERIA

Federal Exemption Criteria:

Section 146.4 of Title 40 of the Code of Federal Regulations. (40 CFR § 146.4)

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in 40 CFR section 146.3 may be determined under 40 CFR section 144.7 to be an "exempted aquifer" if it meets the following criteria:

(a) It does not currently serve as a source of drinking water; and
(b) It cannot now and will not in the future serve as a source of drinking water because:
    (1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.
    (2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;
    (3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or
    (4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or
(c) The total dissolved solids content of the ground water is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.

California State Criteria for Aquifer Exemption Proposals:

California Public Resources Code section 3131, subdivision (a). (PRC § 3131(a))

To ensure the appropriateness of a proposal by the state for an exempted aquifer determination subject to any conditions on the subsequent injection of fluids, and prior to proposing to the US EPA that it exempt an aquifer or portion of an aquifer pursuant to 40 CFR section 144.7, the Division shall consult with the appropriate regional water quality control board and the State Water Board concerning the conformity of the proposal with all of the following:

(1) Criteria set forth in Section 146.4 of Title 40 of the Code of Federal Regulations.
(2) The injection of fluids will not affect the quality of water that is, or may reasonably be, used for any beneficial use.
(3) The injected fluid will remain in the aquifer or portion of the aquifer that would be exempted.

BASIS FOR EXEMPTION

The Proposal Area meets the federal criteria for aquifer exemption, as described in 40 CFR sections 146.4(a) and 146.4(b)(1).

The Proposal Area also meets the California criteria for proposal of an aquifer exemption to the US EPA, as described in PRC section 3131(a).

Proposal Area Meets Federal Exemption Criteria

It does not currently serve as a source of drinking water. (40 CFR § 146.4(a))

The Proposal Area does not currently serve as a source of drinking water. A search was conducted to identify water supply wells located within at least a quarter mile radius around the Proposal Area. The search involved a review of public databases of water well information, including data files maintained by the Department of Water Resources and the County of Santa Barbara. The search was further informed by identification of existing wells using a combination of aerial imaging and ground surveillance. The search identified no water supply wells completed in the portions of the Sisquoc and Monterey Formations proposed for exemption. All identified water supply wells located in proximity to the Proposal Area are completed in shallower formations that are geologically and hydraulically isolated from the Sisquoc and Monterey Formations.

It cannot now and will not in the future serve as a source of drinking water because it is hydrocarbon producing or contains hydrocarbons that are expected to be commercially producible. (40 CFR § 146.4(b)(1))

Information presented in the proposal materials supports a conclusion that the Proposal Area is hydrocarbon producing or contains hydrocarbons that are expected to be commercially producible. This information consists of:

- Historic and active oil production data in the proposed area;
- Geophysical well logs indicating the presence of hydrocarbons;
- Mud logs (detailed subsurface soil and rock descriptions) indicating the presence of hydrocarbons; and
- Lithologic core analysis showing current and residual hydrocarbons in the formation.

The furthest extent of the oil (lowest known oil) within the Sisquoc and Monterey Formations was determined by evaluating production records, mud logs, geophysical logs, and core data for all the wells in the outlying areas of the oil field. Historic production records provide data on productive areas and the volumes of oil produced. Mud logs record the drilling process and contain detailed geologic descriptions of the rocks and fluids (e.g., oil) that come out of the borehole. Like mud logs, core data also provide descriptions of the rocks (or core) from the borehole, but in a more descriptive manner. Cores are routinely submitted to a laboratory and analyzed for permeability, porosity, and percentage of oil saturation. Geophysical logs measure various attributes of the rock formations and the fluids within them (resistance to electricity, spontaneous electric potential, radioactivity, density, etc.). Analyzed geophysical logs give insight to the types of reservoir fluids (e.g., oil) and their relative volumes. Because oil tends to float evenly on top of water due to density differences and immiscibility, the boundary of the lowest known oil generally follows

contours of equal elevation unless a permeability barrier is reached (e.g., a fault or less permeable rock). Permeability barriers are what trap oil, and they prevent all types of fluids from migrating out of the oil reservoir. In the case of the Proposal Area, oil has been trapped along faults and against impervious or less permeable rock.

Proposal Area Meets California State Criteria for Aquifer Exemption Proposals

The Proposal Area meets US EPA exemption criteria. (PRC § 3131(a)(1))

As discussed above, the Proposal Area meets the federal criteria for aquifer exemption — specifically, 40 CFR sections 146.4(a) and 146.4(b)(1).

The injection of fluids into the Proposal Area will not affect the quality of water that is, or may reasonably be, used for any beneficial use. (PRC § 3131(a)(2))

Water is produced from the Sisquoc and Monterey Formations in connection with oil operations in the Cat Canyon Oil Field. The produced water is treated to remove hydrocarbon content, and it is re-injected into the Sisquoc and Monterey Formations for enhanced oil recovery or as waste disposal. The requirement of PRC § 3131(a)(2), that the injected fluids not affect the quality of water that is, or may reasonably be, used for any beneficial use is satisfied because (1) the groundwater within the proposed exempted area contains petroleum hydrocarbons and constituents such as boron and total dissolved solids at concentrations that limit its suitability for agricultural, domestic, and other beneficial uses, (2) because of the availability of higher quality groundwater in shallower geologic zones, and (3) because the injected fluids are expected to remain in the proposed exempted area.

The injected fluid will remain in the aquifer or portion of the aquifer that would be exempted. (PRC §3131(a)(3))

Injected fluids are expected to remain in the proposed exempted area due to both geologic and operational controls. Vertical containment of the proposed exempted area is provided by the overlying low permeability Upper Confining Layer of the Sisquoc Formation, the underlying low permeability shale of the Point Sal Formation, and a production-induced inward hydraulic gradient. Lateral containment in the proposed exempted area is provided by a geologic pinch-out (on the north and south), faults sealed to fluid flow that create isolated fault blocks, and a production-induced inward hydraulic gradient within those blocks.

Project-Level Conditions

Approval of Class II injection projects involves a joint review by staff from the Division and the Water Boards. Division staff and Water Boards staff may incorporate conditions into approvals of injection projects within the Proposal Area, as appropriate to serve their respective regulatory missions. Potential conditions include, but are not limited to, the following:

- Providing data to demonstrate an inward hydraulic gradient and to demonstrate that injected fluids will remain in the exempted area; and
- Monitoring to demonstrate that injected fluids remain in the exempted area.

If a monitoring requirement is incorporated in a project approval, the operator must submit a plan to the Central Coast Regional Water Quality Control Board for consideration.

CONCLUSION

Information presented in the proposal materials supports the following conclusions regarding the Proposal Area:

1) The Proposal Area does not currently serve as a source of drinking water;
2) The Proposal Area cannot now and will not in the future serve as a source of drinking water because it is hydrocarbon producing or contains hydrocarbons that are expected to be commercially producible;
3) The injection of fluids into the Proposal Area will not affect the quality of water that is, or may reasonably be, used for any beneficial use; and
4) The injected fluids will remain in the aquifer or portion of the aquifer that would be exempted.

Based on these factors, as further discussed in the supporting proposal materials, and pending review of all timely and relevant comments from the public, with the concurrence of the State Water Board, the Division intends to recommend that the US EPA designate the Proposal Area an exempted aquifer for purposes of receiving fluids from Class II injection wells.

Sisquoc and Monterey Formations, Aquifer Exemption Location Map